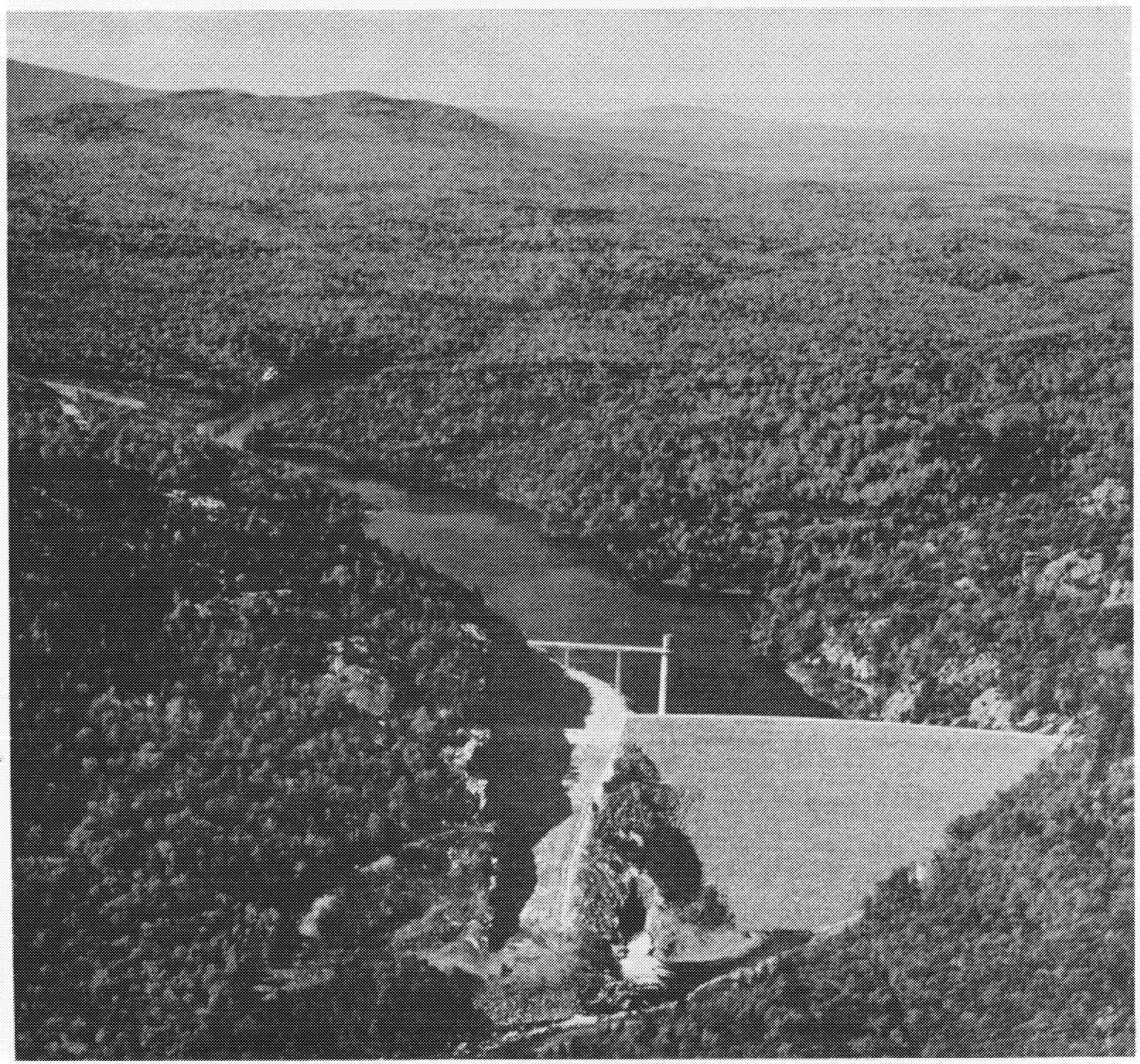
US Army Corps
of Engineers
New England Division

Drought Contingency Storage Plan

MARCH 1985

Ball Mountain Lake, Jamaica, Vermont



CONNECTICUT RIVER BASIN
WEST RIVER WATERSHED

DROUGHT CONTINGENCY STORAGE PLAN
BALL MOUNTAIN LAKE
JAMAICA AND LONDONDERRY, VERMONT

MARCH 1985

NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02254-9149

SYLLABUS

A drought contingency storage plan was studied for Ball Mountain Lake in an effort to be responsive to public needs during drought situations. It was determined that water could be temporarily stored to an elevation of 875 feet NGVD, 4.5 feet above the permanent pool, providing up to approximately 2,700 acre-feet (880 million gallons) of reservoir storage for drought emergency purposes.

An evaluation of the potential effects of this plan has revealed no major adverse impacts at this time. The water at Ball Mountain Lake is of good quality, but has high levels of color and moderate levels of iron which will have to be removed before it is usable for public water supply.

DROUGHT CONTINGENCY PLAN
BALL MOUNTAIN LAKE

TABLE OF CONTENTS

TABLE OF CONTENTS (Cont.)

LIST OF TABLES

LIST OF PLATES

DROUGHT CONTINGENCY STORAGE PLAN
BALL MOUNTAIN LAKE

1. PURPOSE AND SCOPE

The purpose of this study and report was to develop and set forth a drought contingency storage plan of operation for Ball Mountain Lake that would be responsive to public needs during drought periods and identify possible modifications to project regulation within current administrative and legislative constraints. This plan was based on preliminary studies utilizing readily available information. Included are a description of existing water supply conditions, the potential for allocation of reservoir storage within specified limits, an evaluation of water quality, a discussion of impacts on other project purposes, the effects on the environment, and a summary and conclusions.

2. AUTHORIZATION

The authority for the preparation of drought contingency plans is contained in ER 1110-2-1941 which provides that water control managers will continually review and, when appropriate, adjust water control plans in response to changing public needs. Drought contingency plans will be developed on a regional, basin-wide and project basis as an integral part of water control management activities.

3. PROJECT AUTHORIZATION CONDITIONS

Ball Mountain Lake is a unit of the comprehensive plan for flood control in the Flood Control Act of 1938 (Public Law 761, 75th Congress, 3rd Session) as modified by the Flood Control Act of 1941 (Public Law 228, 77th Congress, 1st Session) and the Flood Control Act of 1944 (Public Law 534, 78th Congress, 2nd Session). Construction of the project was initiated in April 1956 and completed in October 1961.

4. PROJECT DESCRIPTION

Ball Mountain Lake is a multipurpose project located on the West River in the Connecticut River basin, Jamaica, Vermont. A map of the Connecticut River basin is shown on plate 1.

The project contains storage for flood control and recreation. A small permanent pool is maintained to facilitate gate operations during he winter months. This 20-acre pool at elevation 830.5 feet NGVD has a water depth of 25 feet and about 240 acre-feet of storage. A conservation pool at elevation 870.5 feet NGVD is maintained during the recreation season. It has a maximum depth of 65 feet, an area of 75 acres and utilizes a net storage of 2,000 acre-feet. During the late fall, winter and spring months there is a net storage of 54,450 acre-feet set aside for flood control purposes, which is equivalent to 5.90 inches of runoff from the 172 square mile drainage area. During the recreation season, the net storage is reduced to 52,450 acre-feet, equivalent to 5.70 inches of runoff. A capacity table is shown on plate 2.

The physical components of the project consist of a rolled earthfilled dam with rock slope protection, chute spillway, outlet works, facilities for recreational purposes and storage for flood control and recreation. The outlet works consist of an intake tower, a conduit and an outlet channel. The intake tower houses the equipment necessary to operate the three 5′8" wide by 10′0" high gates that control the flow in the 13′6" diameter, 864-foot long concrete circular conduit.

A summary of pertinent data at Ball Mountain Lake is listed on plate 3.

5. PRESENT OPERATING REGULATIONS

a. Normal Periods. The permanent pool, at an approximate stage of 25 feet, and the recreation pool at an approximate stage of 65 feet, are maintained by the closure of 2 of the gates and throttling of the third.

b. Flood Periods. Ball Mountain is operated in concert with other projects in the basin to reduce downstream flooding in the Connecticut River basin. Operations for floods may be considered in three phases: phase I -appraisal of storm and river conditions during development of a flood, phase II - flow regulation and storage of flood runoff at the reservoir, and phase III - emptying the reservoir during recession of the flood. The regulation procedures are detailed in the Master Water Control Manual for the Connecticut River basin.

c. Regulating Constraints

(1) Minimum Releases. A minimum release of

approximately 20 to 30 cfs is maintained during periods of flood regulation in order to sustain downstream fish life.

(2) Maximum Releases. The maximum nondamaging discharge immediately downstream of Ball Mountain Lake is about 5,000 cfs.

6. MONITORING OF HYDROLOGIC CONDITIONS

The Reservoir Control Center directs the reservoir regulation activities at 28 New England Division flood control dams, and continually monitors rainfall, snow cover and runoff conditions throughout the region. When any of these hydrologic parameters have been well below normal for several months and it appears that possible drought conditions might develop, the Corps Emergency Operations Center (EOC) will be so informed. The EOC will then initiate discussions with the respective Federal and State agencies and other in-house Corps elements to review possible drought concerns and future Corps actions.

7. DESCRIPTION OF EXISTING WATER SUPPLY CONDITIONS

a. General. The area of concern is the eastern portion of central Vermont encompassing a large part of Windham County. Table 1 contains information about public water supply systems in the area based on information provided by the Vermont Department of Health, Division of Environmental Health. Of the 15 communities in the study area, two of the communities are at least partially supplied by municipally owned and operated public water supply systems. Parts of six communities are partially supplied by privately owned and operated water supply systems. Included in table 1 are privately owned systems with greater than 20 service connections and a maximum daily demand of at least 0.01 mgd. An exception was made in one instance, Vermont Academy in Rockingham,with fewer than 20 connections but where demand far exceeded the 0.01 mgd maximum daily demand cutoff.

b. Water Supply Systems. The primary objective of this analysis was to accumulate available data regarding water supply systems in the vicinity of Ball Mountain Lake that could benefit from storage at the project, and to present the data in a manner portraying existing water supply conditions. Projections of future demands were not developed because this study addresses only modifications in the operational procedures at Ball

Mountain Lake in order to provide storage for water supply purposes when drought conditions exist, and not to meet normal water supply demands at some future date.

c. Eastern Central Vermont Water Supply. As noted in table 1, the data given for each water supplier includes: type of ownership, community served, service connections served by the system, source of supply (ground or surface water), average day and maximum day demands for 1981, estimated safe yield of the source, and any further information available on the source of supply. An analysis of the adequacy of existing sources during drought conditions has not been performed. The information has been accumulated to present a summary of the existing water supply conditions for the eastern central Vermont area.

d. Population Projections. Population projections for communities in the study area are given in table 2 to show population trends for each community potentially affected by a prolonged dry period. The projections were provided by the Vermont State Planning Office. The high series of population projections, assuming migration rates through the year 2000 will continue at the rate observed from 1970-1980, are included in this report.

8. POTENTIAL FOR WATER SUPPLY REALLOCATION

a. General. There are several authorities that provide for the use of reservoir storage for water supply at Corps of Engineers projects. They vary from the provision of water supply storage as a major purpose in new projects to the discretionary authority to provide emergency supplies to local communities in need. In addition, guidance contained in ER 1110-2-1941 directs field offices to determine the short-term water supply capability of existing Corps reservoirs that would be functional under existing authorities. Congressional authorization is not required to add municipal and industrial water supply if the related revisions in regulation would not significantly affect operation of the project for the originally authorized purposes.

b. Drought Contingency Storage. It has been determined that a portion of the existing storage at Ball Mountain Lake could be utilized for emergency drought contingency storage without having an impact on the project's flood control and recreation functions. Storage could be made available to a pool elevation of approximately 875 feet NGVD (70-foot stage). This represents a volume of about 2,700 acre-feet, equivalent

TABLE 1
MAJOR WATER SUPPLIERS - EASTERN CENTRAL VERMONT

Company or Agency	Ownership	Town Served	Service Connections	Source of Supply GW/SW	1981 Demand Avg. Day (MGD)	1981 Demand Max. Day (MGD)	Supply Source	Safe Yield (MGD)
Cavendish Fire Dist.	Municipal	Cavendish	94	GW	0.040	0.075	Gravel Well	0.360
Proctorsville Water Dept.	Municipal	Cavendish	140	GW	0.045	0.060	Gravel Well	0.216
Chester Water Dept.	Municipal	Chester	463	GW	0.105	0.210	Canal St. Gravel Well	0.266
							Jeffrey Gravel Well	0.576
Magic Village Coop.	Cooperative	Londonderry	52	GW	0.016	0.031	Rock Well #1	-
							Rock Well #2	0.006
							Rock Well #3	0.007
Green Mtn. Weight Control	Private	Ludlow	40	GW	0.011	0.033	Rock Well	0.036
Ludlow Village Water Dept.	Municipal	Ludlow	620	GW	0.230	0.460	Spring	0.800
Okemo Trailside Condos	Private	Ludlow	53	GW	0.030	0.060	Rock Well #1	0.009
							Rock Well #3	0.022
							Rock Well #4	0.032
							Rock Well #6	0.065
Okemo Village Condo	Private	Ludlow	22	GW	0.011	0.022	Rock Well	0.012
Bellows Falls Water Dept.	Municipal	Rockingham	1,000	SW	0.600	1.200	Minards Pond	2.600
							Ellis Brook	2.500
							Farr Brook	0.155
North Shore Trailer Park	Private	Rockingham	22	GW	0.006	0.011	Well Point	0.017
Vermont Academy	Private	Rockingham	18	SW/GW	0.020	0.040	Brook Impoundment (Emgergency)	0.020
							Rock Well	0.050
Cyr's Trailer Park	Private	Springfield	70	GW	0.018	0.035	Rock Well #1 (Standby)	-
							Rock Well #2	0.019
							Rock Well #3	0.020
							Rock Well #4	0.013
Springfield Water Dept.	Municipal	Springfield	2,200	GW	1.300	2.400	Chapman Wellfield I	0.720
							Gilchrist Wellfield	0.030
							Chapman Meadows II	0.450
Country Estates Mobile Home Park	Private	Weathersfield	103	GW	0.023	0.047	Rock Well #1	-
							Rock Well #2	-
							Rock Well #3	-
							Rock Well #4	-
McAllister	Cooperative	Weathersfield	20	GW	0.006	0.012	Rock Well	0.007
							Spring (Standby)	0.007

TABLE 2

POPULATION PROJECTIONS
EASTERN CENTRAL VERMONT

Town	Actual 1980	1985	1990	1995	2000	Percent Change 1980-2000
Athens	250	281	318	348	373	49.2
Brattleboro	11,886	12,438	12,834	13,459	13,992	17.7
Brookline	310	353	409	452	488	57.4
Dover	666	715	769	819	862	29.4
Dummerston	1,574	1,696	1,830	1,954	2,059	30.8
Grafton	604	656	717	769	814	34.8
Jamaica	681	728	776	824	866	27.2
Londonderry	1,510	1,669	1,869	2,028	2,163	43.2
Newfane	1,129	1,220	1,323	1,415	1,494	32.3
Putney	1,850	1,959	2,059	2,175	2,273	22.9
Rockingham	5,538	5,821	6,043	6,353	6,616	19.5
Townsend	849	920	1,000	1,071	1,131	33.2
Wardsboro	505	548	598	641	678	34.3
Westminster	2,493	2,718	2,985	3,210	3,402	36.5
Windham	223	242	263	282	298	33.6
TOTAL	30,068	31,964	33,793	35,800	37,509	23.7

to 878 mg or approximately 5 percent of the total reservoir storage. This volume is comprised of 240 acre-feet of permanent storage and 2,470 acre-feet of flood control storage. Of the 2,470 acre-feet of flood control storage, 2,000 acre-feet is allotted to a recreational season conservation pool. The 2,470 acre-feet represents an infringement of about 0.27 inches of runoff on the flood control storage.

Based on an all-season low flow duration analysis using 35 years of flow records for the gaging station on West River at Jamaica, Vermont and prorating by the drainage area ratio backup to the dam (Ball Mountain DA = 172 sq.mi., gaging station DA = 179 sq. mi.), it was determined that during a 10-year frequency drought, the volume of runoff could: a) fill the reservoir from elevation 830.5 to 875 feet NGVD in a 53-day summer period provided no releases were made from the dam or, b) fill the reservoir to elevation 875 in a 96-day period if a continuing release of approximately 17 cfs (0.1 cfs/sq.mi.) were maintained. However, the reservoir could be filled to elevation 875 feet NGVD in about a 16-day period in May while continuously releasing 30 cfs. The stored water could be used for municipal supply with proper treatment, either by drawing directly from the reservoir or releasing the waters for downstream withdrawal. Drought contingency storage versus flow duration at Ball Mountain Lake is shown graphically on plate 4.

c. Effects of Regulated Flows. The curtailment of flows from Ball Mountain Lake during the drought emergency could adversely impact on the flowage rights of downstream riparian users. At this time, however, it is not possible to review all of the various drought emergency situations that could occur, nor is it within the scope of this report to identify all those with water rights. It is important to note that when a specific drought emergency does occur, the legal implications would have to be weighed.

9. WATER QUALITY EVALUATION

a. Water Quality Classification. The waters of the West and Winhall Rivers upstream from Ball Mountain Lake are rated class B by the Vermont legislature. Class B waters are suitable for bathing and recreation, irrigation and agricultural uses; good fish habitat; good aesthetic value, acceptable for public water supply with filtration and disinfection. In addition, the waters have also been classified as a cold water fishery.

Technical requirements for Vermont class B waters include minimum dissolved oxygen (DO) concentrations of 6 mg/l for a cold water fishery, pH in the range of 6.5 to 8.0 standard units (SU), fecal coliform bacteria not to exceed 200/100 ml, turbidity levels not to exceed 10 JTU, and color not to exceed 25 pt-co units.

b. Existing Water Quality. There are no known significant point source discharges upstream and the waters of Ball Mountain Lake are of good quality generally meeting or exceeding the requirements of their Vermont class B designation. Historically, individual waste discharges existed in South Londonderry and in a number of ski resorts, producing intermittent high coliform levels at the project. These sites appear to have been identified by the state and subsequently eliminated since recent coliform testing has shown no violations. Dissolved oxygen (DO) levels are consistently high in the project area with one exception; the low DO levels which were measured during late summer in the bottom of the thermally-stratified, 65-foot deep recreation pool. Turbidity and nitrogen levels are low within the lake, while phosphorus levels are just slightly above that needed to maintain an algae bloom. Algae growth in the lake is assumed to be nitrogen limited.

Although Ball Mountain Lake water quality is good, previous measurements have indicated that some treatment will be required for water supply usage. Natural conditions (woodlands, marshes) along the West River and its tributaries contribute to high color levels, moderate iron levels, and occasional low pH levels.

Low pH levels, also affected by acid rain runoff, frequently violate state criteria. In a public water supply, low pH levels are not a health problem but may cause serious corrosion problems.

Moderate iron levels and high color concentrations do not violate state standards and are not health hazards. However, high levels of iron can cause taste and laundry-staining problems and high color levels are unappealing to the consumer. Both can be reduced by standard treatment processes.

Ball Mountain Lake is considered an oligotrophic impoundment with a hydraulic residence time of 12 to 14 days under normal summer flow conditions. Under minimum summer flow conditions, the hydraulic residence time

increases to over two months. The low nutrient levels and relatively short hydraulic residence time indicates that the lake should be protected from algae blooms. Temperatures at the various sampling points at the project are occasionally a few degrees higher than the optimum (68°F) necessary to support a good cold water fishery, but do not exceed the 85°F maximum necessary to support a warm water fishery.

c. Water Quality Requirements for Drought Storage. There are two requirements to be met. The waters must meet state standards for surface waters and must be of a quality appropriate for the water supply user. A water which meets class B standards in Vermont is usable for public water supply with standard treatment processes. The water quality required for industrial water supply depends on the industrial process involved. The water at Ball Mountain Lake would always be of a quality suitable for fire-fighting or irrigation.

d. Effects of Drought Storage. Increasing the size of the pool at Ball Mountain Lake for drought storage will not affect existing water quality in the lake significantly. With the proposed depth increase of 4.5 feet, an additional 12 acres of land would be flooded. The decay of organic material on this land may cause small increases in levels of color and soluble nutrients. Present hydraulic residence time during normal summer flow conditions would increase from 12 to 14 days to 17 to 19 days and under minimum flows would increase from 2 months to 3 months. The trophic status of the lake is not likely to change and the water quality for recreation and fishing will not be affected.

Raising the pool 4.5 feet would also cause slight increases in turbidity and sedimentation. The death of the vegetation in the newly inundated areas would loosen the soil and cause increased erosion in these areas when the pool came down. Most of the eroded soil would settle in the lake, but some would be discharged downstream. This increased erosion and sedimentation will not affect the suitability of the water for water supply or recreation, but will diminish the aesthetics of the area.

e. Water Quality Conclusions. The water at Ball Mountain Lake is of good quality but has high levels of color and moderate levels of iron which will have to be removed before it is usable for public water supply. Undesirable color and iron can be removed by standard treatment processes. No treatment would be required for the water to be acceptable for fire-fighting, irrigation,

or some industrial processes. Increasing the pool elevation by 4.5 feet to provide extra storage would elevate levels of turbidity, color, and erosion and sedimentation somewhat but would not significantly affect the suitability of the water for water supply or recreation.

10. DISCUSSION OF IMPACTS

a. General.

Any action resulting in a temporary change of a reservoir's storage volume may have impacts on other project purposes which must be evaluated before a storage reallocation plan can be implemented. An evaluation has been made of the impacts resulting from drought contingency storage on the flood control purpose of this project. Effects on recreation, sedimentation and the aquatic and terrestrial environments as well as the historic and archaeological resources are also discussed in the following paragraphs. Because of the minimal level of effort afforded this study, certain environmental concerns may require further consideration prior to project implementation.

b. Flood Control.

A review of the regulation procedures at Ball Mountain Lake was undertaken to determine the volume of water that could be made available for drought contingency purposes. The water would be stored by temporarily utilizing existing flood control storage. It is recognized that major floods occur in every season of the year, thus any use of flood control storage would be continually monitored to insure that there would be no adverse impacts on downstream flood protection.

At Ball Mountain the maximum pool level for drought contingency storage would be at elevation 875 feet NGVD, a five foot increase in the present level of the summer recreation pool. This increase represents an infringement on the flood control storage of about 0.27 inches of runoff or five percent of the total flood storage volume. This loss of storage is within acceptable limits established by the Corps of Engineers.

c. Recreation. The proposed drought contingency storage will have no detrimental effect on recreation.

d. Project Operations. Additional operation and maintenance costs as well as possible restoration costs should shore line damage occur must be borne by the user.

e. Effects on the Aquatic Ecosystem.

The aquatic environment of the project area is located along the West River, a tributary of the Connecticut River in eastern Vermont. Tributaries to the West river within the project boundaries include the Winhall River, Winhall Brook, and Lowell Lake Brook. The winter pool, at elevation 830.5 feet NGVD, is approximately 25 feet deep, with a surface area of about 20 acres. The summer recreation lake, at elevation 870.5 feet NGVD, has a maximum depth of approximately 65 feet, and a surface area of about 75 acres.

Fish species in the West River watershed in the vicinity of Ball Mountain Dam include brown and brook trout, smallmouth bass, largemouth bass, and bullheads. Rock bass, sunfish and yellow perch are also found, but in lesser numbers. The trout are found in the colder waters upstream and downstream of Ball Mountain Lake. The bass and other minor species are primarily found in the warmer lake waters. The forty foot drawdown of the pool each winter limits the feasibility of managing a warm water fishery. Utilization of the lake fishery is also limited by the lack of a boat ramp for public access. Raising the level of the lake by 5 feet is not expected to significantly impact the lake fishery.

The West river is included in a comprehensive plan to restore Atlantic Salmon to the Connecticut River Basin. At the present time returning salmon are captured below Holyoke Dam and transferred to a hatchery to produce fry. The young salmon are later returned to the West River above Ball Mountain Lake and return downstream with the natural river flow through the control gates of both Ball Mountain and Townsend Dams. Raising the level of the lake to elevation 875.5 feet NGVD will not have any significant impact on this fishery resource. However, the method of control of downstream releases used to raise the pool level could significantly effect downstream fish habitat by reducing river flow and altering water temperatures. Further investigation of possible impacts to the downstream aquatic environment and salmon migration would need to be a part of any

decision to pursue drought contingency storage at the project.

There are no known endangered aquatic species present in the project area.

f. Effects on the Terrestrial Environment.

Ball Mountain Lake is located in a sparsely settled hilly to mountainous region of southern Vermont on the eastern edge of the Green Mountain National Forest. The area is heavily forested, with open land generally found only along narrow river valleys and lowlands. The dam is situated between Shatterack and Ball Mountains, forming a narrow, steep sided valley with an elevation range of up to one-thousand feet. In this narrow valley, flood water storage at Ball Mountain Dam frequently results in a rapid rise in pool level. Inundation of upland vegetation in the reservoir, while usually only a few days in duration, has damaged and weakened many trees. The reservoir area has now been cleared of trees up to about ten feet above the summer pool elevation.

Within the project bounds, approximately 74 percent of the 965 acres of fee-owned land is forest, 16 percent is open fields, and 10 percent is water area. The forests are primarily northern hardwoods - sugar maple, beech and yellow birch - mixed with scattered stands of white pine, hemlock, fir and spruce. Several open fields abutting the lake and along the West River are old fields once used for hay production or for grazing. Most of these open fields are being maintained by mowing or burning as necessary to prevent natural reforestation. At the mouth of the Winhall River, a public camping area is maintained by weekly mowing during the summer.

The maximum drought contingency pool proposed would increase the surface area of the summer recreation lake from 75 acres to 87 acres, inundating an additional 12 acres. Storage of water at this level will not directly impact tree growth as all trees to this elevation in the reservoir have already been removed. Loss of shrub and herbaceous growth will occur if the period of increase storage exceeds two to three weeks. When implementing a drought storage plan, the alternative of using water already stored for the recreation lake should be weighed against the visual and environmental impacts of long term inundation of additional area of the reservoir.

g. Effects on Wildlife.

The principle wildlife species in the project area include white tail deer, snowshoe hare, gray squirrel, raccoon, ruffed grouse, and woodcock. An increase in pool surface area up to 12 acres could reduce wildlife habitat in the project area for game and non-game wildlife species, but the quality of the area which would be lost is poor, and the loss would not be significant.

The lake provides little suitable habitat for waterfowl due to lack of marshland or emergent shoreline vegetation. Waterfowl do use the lake as a temporary resting site during migration, and this use would not be impacted.

No known rare or endangered wildlife species inhabit the project area. The lake has been used by osprey and bald eagles for feeding, but no nests are known to exist in the area.

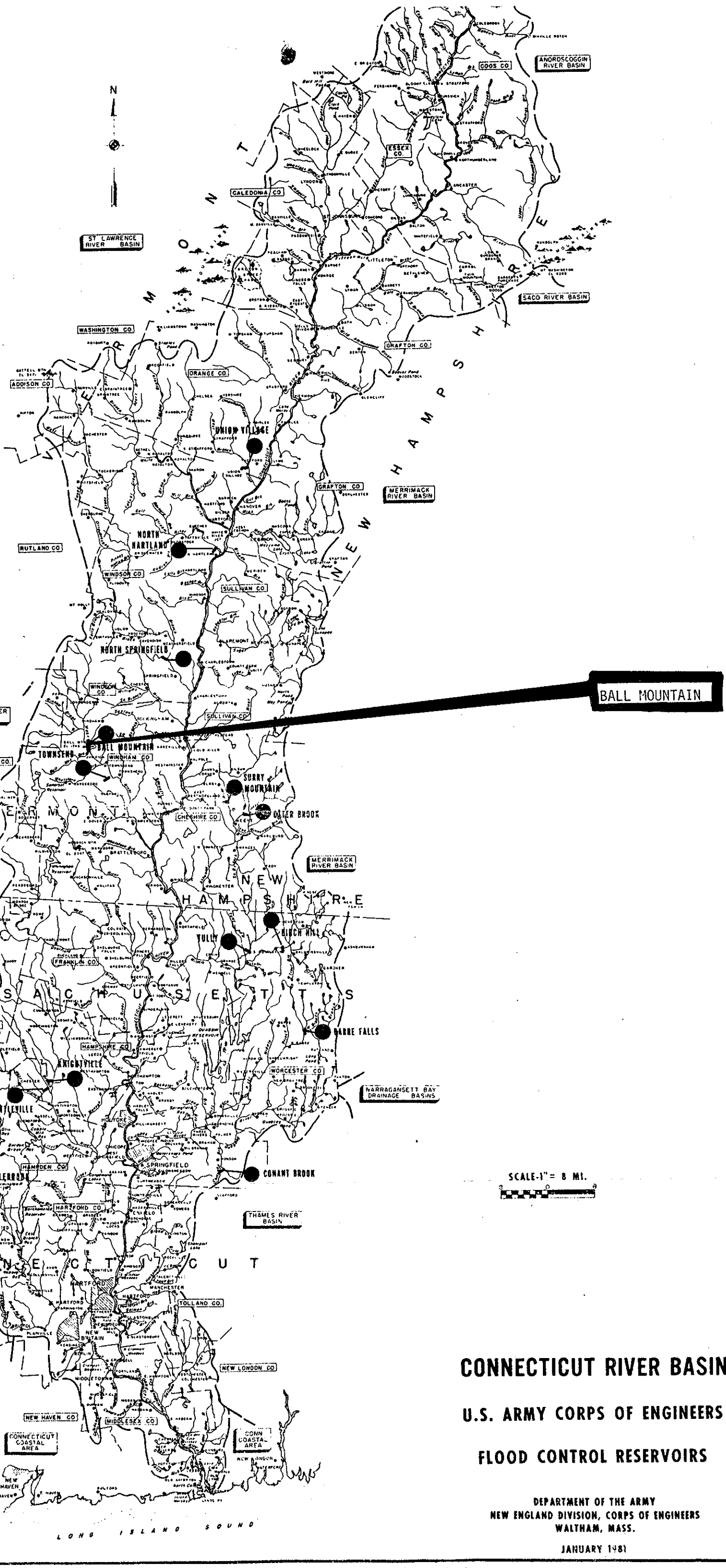
h. Historical and Archaeological Resources.

Archaeological surveys at Ball Mountain Lake have identified two prehistoric and one historic period site at about 885 feet NGVD. These could all be affected by accelerated erosion due to a drought contingency pool at elevation 875 NGVD as they appear to be experiencing gradual erosion due to normal reservoir operation. In order to comply with the requirements of the National Historic Preservation Act, an archaeological erosion monitoring plan should be a part of any decision to pursue drought contingency storage at the project.

11. SUMMARY AND CONCLUSIONS

It has been determined that a portion of the existing storage at Ball Mountain Lake could be utilized for emergency drought purposes without having an adverse impact on the project's flood control functions. The water could be temporarily stored to an elevation of 875 feet NGVD. At this level, 4.5 feet above the permanent pool, it would be possible for the project to provide up to approximately 2,700 acre-feet (880 million gallons) of reservoir storage for drought emergency purposes. An evaluation of the potential effects of this plan has revealed no significant adverse impacts to the project or the environment. A review, for compliance with all current applicable environmental laws, would be required at the time of any decision to pursue drought contingency storage at the project.

The water at Ball Mountain Lake is of basically good quality, but high levels of color and moderate levels of iron will have to be removed before it is usable for public water supply. Undesirable color and iron can be removed by standard treatment processes. No treatment would be required for the water to be acceptable for fire-fighting, irrigation, or some industrial processes.



SCALE-1" = 8 MI.

CONNECTICUT RIVER BASIN

U.S. ARMY CORPS OF ENGINEERS

FLOOD CONTROL RESERVOIRS

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS.

JANUARY 1981

PLATE 1

BALL MOUNTAIN LAKE
AREA AND CAPACITY TABLE

D.A. = 172 s.m.

ELEV. MSL	STAGE FEET	AREA ACRES	CAPACITY AC. FT.	CAPACITY INCHES	REC. SEASON AC. FT.	REC. SEASON INCHES
805.5	0	0	(Gate Invert El. - 805.5)			
810.5	5	4	17	0.01		
815.5	10	8	48	0.01		
820.5	15	12	75	0.01		
825.5	20	16	155	0.02		
830.5	25	20	240	0.05		
		PERMANENT POOL - 830.5'				
835.5	30	27	130	0.01		
840.5	35	34	270	0.03		
845.5	40	41	460	0.05		
850.5	45	48	680	0.06		
855.5	50	55	950	0.10		
860.5	55	62	1250	0.14		
865.5	60	69	1610	0.18		
870.5	65	75	2000	0.22	0	0.00
		CONSERVATION POOL - 870.5'				
875.5	70	87	2470	0.27	470	0.05
880.5	75	100	2960	0.32	960	0.10
885.5	80	112	3530	0.38	1530	0.16
890.5	85	125	4130	0.45	2130	0.23
895.5	90	138	4840	0.52	2840	0.30
900.5	95	151	5570	0.61	3570	0.39
905.5	100	165	6400	0.70	4400	0.48
910.5	105	182	7260	0.79	5260	0.57
915.5	110	200	8250	0.90	6240	0.68
920.5	115	217	9260	1.01	7260	0.79
925.5	120	235	10460	1.14	8460	0.92
930.5	125	256	11690	1.27	9690	1.05
935.5	130	277	13080	1.42	11080	1.20
940.5	135	298	14560	1.58	12560	1.36
945.5	140	320	16060	1.75	14060	1.53
950.5	145	347	17710	1.92	15710	1.70
955.5	150	375	19460	2.07	17460	1.85
960.5	155	402	21360	2.32	19360	2.10
965.5	160	430	23360	2.54	21360	2.32
970.5	165	461	25510	2.78	23510	2.56
975.5	170	492	27860	3.03	25860	2.81
980.5	175	524	30260	3.29	28260	3.07
985.5	180	555	32960	3.58	30960	3.36
990.5	185	594	35760	3.89	33760	3.67
995.5	190	633	38860	4.22	36860	4.00
1000.5	195	672	42060	4.58	40060	4.36
1005.5	200	710	45660	4.96	43660	4.74
1010.5	205	755	49310	5.36	47310	5.14
1015.5	210	800	53260	5.80	51260	5.58
1017.0	211.5	810	54450	5.92	52450	5.70
		SPILLWAY CREST - 1017.0'				
1020.5	215	840	57260	6.23	55260	6.02
1025.5	220	890	61260	6.66	59260	6.45

PLATE 2

PERTINENT DATA
BALL MOUNTAIN LAKE

LOCATION — West River, Jamaica and Londonderry, Vermont

DRAINAGE AREA — 172 square miles

STORAGE USES
- Flood Control
- Recreation

RESERVOIR STORAGE

	Elevation msl	Stage feet	Area acres	Capacity Acre-Feet	Capacity Inches on Drainage Area
Inlet Elevation	805.5	0	0	0	0
Permanent Pool	830.5	25.0	20	240	0.05
Conservation Pool	870.5	65.0	75	2,000 (net)	0.22(net)
Spillway Crest	1017.0	211.5	810	52,450 (net)	5.7 (net)
Maximum Surcharge	1047.0	241.5	1,160	29,550 (net)	3.2 (net)
Top of Dam	1052.0	246.5			

EMBANKMENT FEATURES

Type	Rolled earth fill, rock slope protection, impervious core
Length (ft)	915
Top Width (ft)	20
Top Elevation (ft msl)	1,052.0
Height (ft)	265
Volume (cy)	2,311,000
Dike	None

SPILLWAY

Location	Right-West Abutment
Type	Uncontrolled, ogee weir and chute spillway in rock
Crest Length (ft)	235
Crest Elevation (ft msl)	1,017.0
Surcharge (ft)	30.0
Design Head (ft)	30.0
Maximum Discharge Capacity (cfs)	150,000

OUTLET WORKS

Type	Circular concrete tunnel
Tunnel Inside Diameter (ft)	13.5
Tunnel Length (ft)	864
Service Gate Type	Hydraulic slide
Service Gate Size	Three, 5'-8" x 10'-0"
Emergency Gate Type	None (stoplogs only)
Downstream Channel Capacity (cfs)	5,000±
Maximum Discharge Capacity Spillway Crest Elevation (cfs)	10,400
Stilling Basin	None

PERMANENT POOL

Length (ft)	3,600
Shoreline Length (ft)	7,500
Area (acres)	20

CONSERVATION POOL

Length (ft)	9,700
Shoreline Length (ft)	19,500
Area (acres)	75

LAND ACQUISITION

	El. (ft msl)	Stage (ft)	Area (acres)
Fee Taking	985	179.5	965
Easement	1,057	251.5	262
Clearing	870±	64.5	

MAXIMUM POOL OF RECORD

Date	April 24, 1969
Stage (ft)	197.8
Percent Full	82

SPILLWAY DESIGN FLOOD

	Original Design 1956	1967 Analysis
Peak Inflow (cfs)	190,000	190,000
Peak Outflow (cfs)	162,800	162,800*

* 150,000 Spillway Discharge; 12,800 Conduit Discharge

UNIT RUNOFF
One Inch Runoff (acre-ft) — 9,180

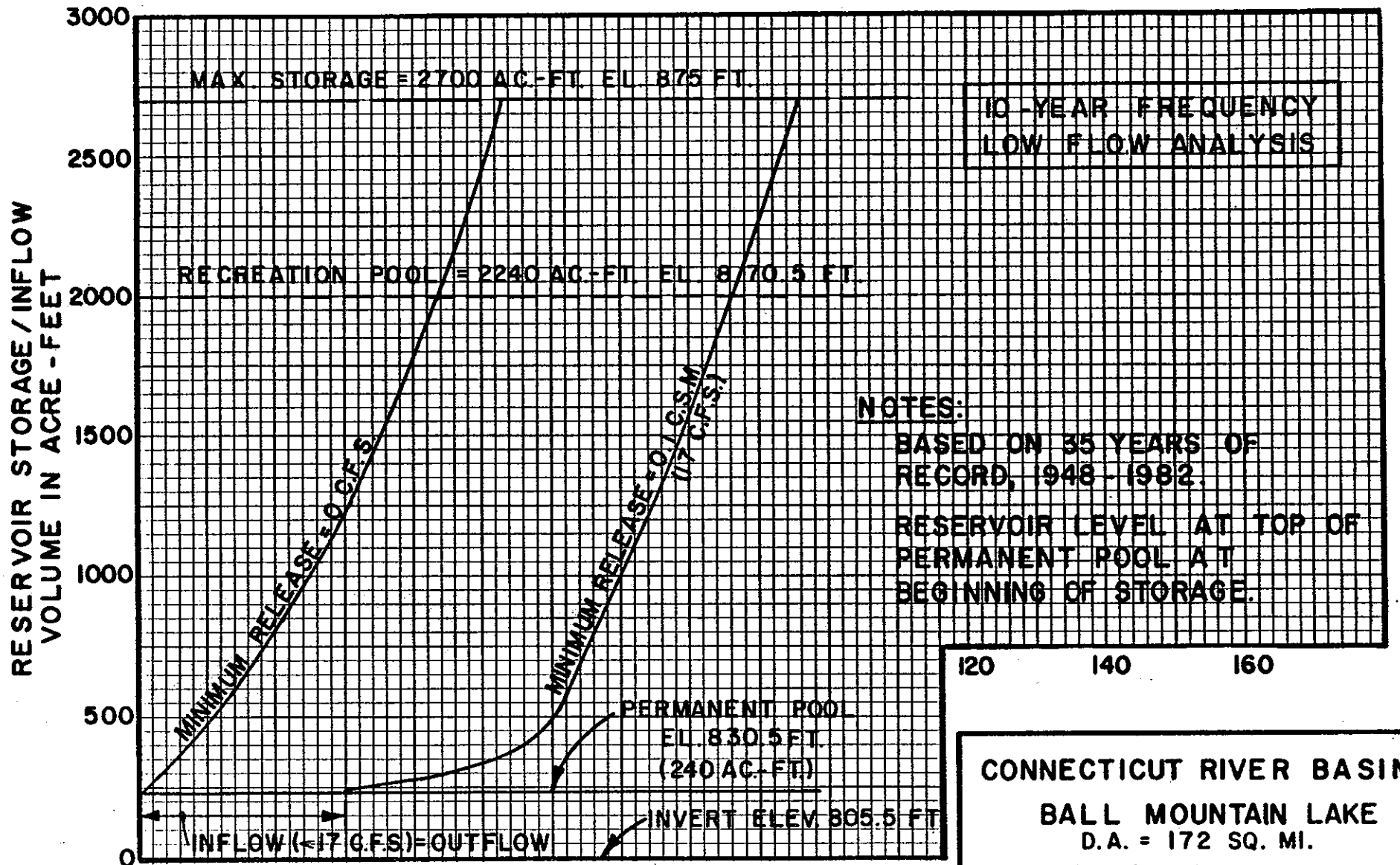
OPERATING TIME
Open/Close all Gates — 10 min. (Manual Operation: 90 turns/ft)

PROJECT COST (thru FY71) — $10,585,000

DATE OF COMPLETION — October 1961

MAINTAINED BY — New England Division, Corps of Engineers

PLATE 3



10-YEAR FREQUENCY LOW FLOW ANALYSIS

NOTES:

BASED ON 35 YEARS OF RECORD, 1948-1982.

RESERVOIR LEVEL AT TOP OF PERMANENT POOL AT BEGINNING OF STORAGE.

CONNECTICUT RIVER BASIN

BALL MOUNTAIN LAKE

D.A. = 172 SQ. MI.

DROUGHT CONTINGENCY STORAGE VS. FLOW DURATION

PLATE 4

N

BALL MOUNTAIN DAM

SPILLWAY

OUTLET WORKS

FLOW LINE AT SPILLWAY CREST EL. 1017.0'

WINDHAM
LONDONDERRY

LIMIT OF GOVERNMENT OWNED LAND

WINHALL CAMPING AREA

RELOCATED STATE AID ROAD 2

SOUTH LONDONDERRY

RELOCATED COLE POND ROAD

ACCESS ROAD

TO ROUTE 100 11

TO LONDONDERRY

TO JAMAICA

TO PERU

RAWSONVILLE

COBB BROOK

LOWELL LAKE BROOK

WEST RIVER

WINHALL BROOK

LONDONDERRY JAMAICA

COLE POND

BALL MOUNTAIN

SCALE IN FEET
1000' 0 1000' 2000'

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION
CORPS OF ENGINEERS
WALTHAM, MASS.

WATER RESOURCES DEVELOPMENT PROJECT

CONNECTICUT RIVER BASIN

BALL MOUNTAIN DAM

RESERVOIR MAP

CONNECTICUT RIVER NEW HAMPSHIRE

APRIL 1963

PLATE 5